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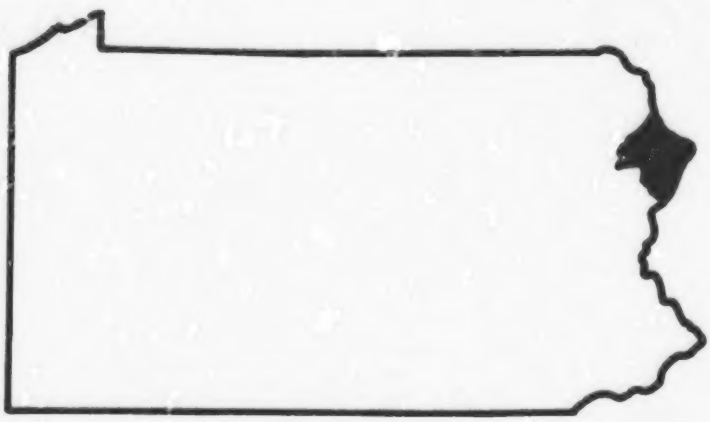
FLOOD INSURANCE STUDY

TOWNSHIP OF BLOOMING GROVE, PENNSYLVANIA
PIKE COUNTY



OCTOBER 18, 1988

COMPLETED

Federal Emergency Management Agency

COMMUNITY NUMBER - 421962

ORIGINAL

NOTICE TO
FLOOD INSURANCE STUDY USERS

Communities participating in the National Flood Insurance Program (NFIP) have established repositories of flood hazard data for floodplain management and flood insurance purposes. This Flood Insurance Study (FIS) may not contain all data available within the repository. It is advisable to contact the community repository for any additional data.

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FLOOD INSURANCE STUDY
TOWNSHIP OF BLOOMING GROVE, PIKE COUNTY, PENNSYLVANIA

1.0 INTRODUCTION

1.1 Purpose of Study

This Flood Insurance Study investigates the existence and severity of flood hazards in the Township of Blooming Grove, Pike County, Pennsylvania, and aids in the administration of the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973. This study has developed flood risk data for various areas of the community that will be used to establish actuarial flood insurance rates and assist the community in its efforts to promote sound floodplain management. Minimum floodplain management requirements for participation in the National Flood Insurance Program (NFIP) are set forth in the Code of Federal Regulations at 44 CFR, 60.3.

In some states or communities, floodplain management criteria or regulations may exist that are more restrictive or comprehensive than the minimum Federal requirements. In such cases, the more restrictive criteria take precedence and the state (or other jurisdictional agency) will be able to explain them.

1.2 Authority and Acknowledgments

The sources of authority for this Flood Insurance Study are the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973.

The hydrologic and hydraulic analyses for this study were prepared by the Philadelphia District of the U. S. Army Corps of Engineers (COE) for the Federal Emergency Management Agency (FEMA), under Inter-Agency Agreement No. EMW-85-E-1822, Project Order No. 1, Amendment No. 16. This work was completed in January 1987.

1.3 Coordination

In December 1984, an initial Consultation and Coordination Officer's (CCO) meeting was held with representatives of FEMA and the township to determine the streams to be studied by detailed methods. A search for basic data was made at all levels of government. A map was supplied by community officials and topographic maps were obtained from the U. S. Geological Survey (USGS). On November 23, 1987, a final CCO meeting was held with representatives of FEMA, the township, and the COE (the study contractor) to review the results of the study.

2.0 AREA STUDIED

2.1 Scope of Study

This Flood Insurance Study covers the incorporated area of the Township of Blooming Grove, Pike County, Pennsylvania. The area of study is shown on the Vicinity Map (Figure 1).

The following streams were studied by detailed methods: Billings Creek, from the confluence with Shohola Creek to a point approximately 0.5 mile upstream of Legislative Route 51019; Blooming Grove Creek, from State Route 402 to a point approximately 0.6 mile upstream of the confluence of Fairview Outlet; and Shohola Creek, from the confluence of McConnell Creek to a point approximately 40 feet upstream of T-410 (Spring Road). The areas studied by detailed methods were selected with priority given to all known flood hazard areas and areas of projected development and proposed construction through January 1992.

York Creek, McConnell Creek, and the remaining portions of Blooming Grove Creek and Shohola Creek were studied by approximate methods. Approximate analyses were used to study those areas having a low development potential or minimal flood hazards. The scope and methods of study were proposed to, and agreed upon by, FEMA and the Township of Blooming Grove.

2.2 Community Description

The Township of Blooming Grove is located in central Pike County in Pennsylvania. It is bordered by the Townships of Palmyra, Lackawaxen, and Shohola to the north; the Township of Dingman to the east; the Township of Porter and Greene to the south; and the Township of Palmyra to the west. The township covers an area of approximately 47,000 square miles and had a 1982 population of 1,266. It is a second class township that is governed by a three member board of supervisors.

The topography of the area ranges from steep mountain ridges to gently rolling hills with numerous swamp lands, lakes, ponds, and minor streams. Approximately 27 percent of the land is owned by the Bureau of Forestry and 15 percent of the land within the township is owned by the State Game Commission. Although much of the area is still undeveloped, Blooming Grove was the fastest growing municipality in housing units for Pike County from 1970 to 1980, and the trend is continuing.

The climate in this geographic area is characterized by temperatures ranging from an average high of 68 degrees Fahrenheit (°F) in summer and 30°F in winter. The average annual rainfall for the region is 44 inches.

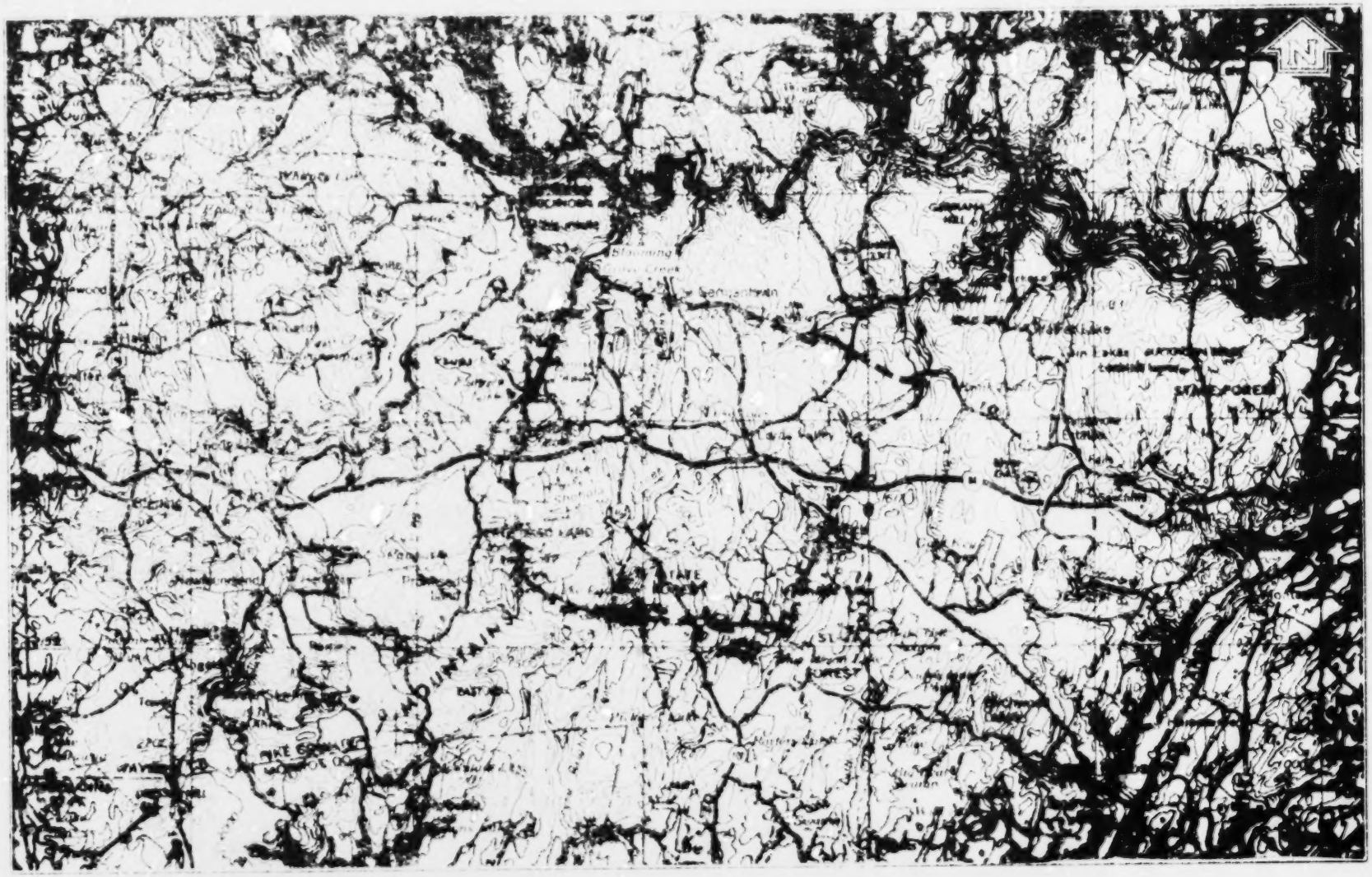

FIGURE 1

FEDERAL EMERGENCY MANAGEMENT AGENCY

TOWNSHIP OF BLOOMING GROVE, PA

(PIKE CO.)

APPROXIMATE SCALE

0 4 8 12 MILES

VICINITY MAP

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2.3 Principal Flood Problems

The principal flood problems in the Township of Blooming Grove are associated with the upper portions of Blooming Grove Creek, the lower portions of Billings Creek, and Shohola Creek near Billings Creek. However, information is unavailable relative to past flood events in Blooming Grove.

2.4 Flood Protection Measures

There are no local flood protection measures in the Township of Blooming Grove. Residents of the township depend on the usual warnings issued through radio, television, and local newspapers for information concerning possible flood conditions. Flood warnings and predicted flood peaks are issued by the National Oceanic and Atmospheric Administration (NOAA) Flood Forecasting Centers located in Harrisburg, Pennsylvania, and Trenton, New Jersey.

3.0 ENGINEERING METHODS

For the flooding sources studied in detail in the community, standard hydrologic and hydraulic study methods were used to determine the flood hazard data required for this study. A flood event of a magnitude which is expected to be equaled or exceeded once on the average during any 100-year period (recurrence interval) has been selected as having special significance for floodplain management and for flood insurance rates. This event, commonly termed the 100-year flood, has a 1 percent chance of being equaled or exceeded during any year. Although the recurrence interval represents the long term average period between floods of a specific magnitude, rare floods could occur at short intervals or even within the same year. The risk of experiencing a rare flood increases when periods greater than 1 year are considered. For example, the risk of having a flood which equals or exceeds the 100-year flood (1 percent chance of annual exceedence) in any 50-year period is approximately 40 percent (4 in 10), and, for any 90-year period, the risk increases to approximately 60 percent (6 in 10). The analyses reported herein reflect flooding potentials based on conditions existing in the community at the time of completion of this study. Maps and flood elevations will be amended periodically to reflect future changes.

3.1 Hydrologic Analyses

Hydrologic analyses were carried out to establish the peak discharge-frequency relationships for each flooding source studied in detail affecting the community.

All USGS stream gages with a reasonable number of years of record in Monroe, Wayne, Pike, and nearby counties were analyzed. A flood frequency analysis to determine the 100-year event for the streams studied by detailed methods was performed. This produced records of drainage areas and 100-year flood events that were plotted to generate a regional curve.

A summary of the drainage area-peak discharge relationships for the streams studied by detailed methods is shown in Table 1, "Summary of Discharges."

TABLE 1 - SUMMARY OF DISCHARGES

FLOODING SOURCE AND LOCATION	DRAINAGE AREA (sq. miles)	PEAK DISCHARGE (cfs) 100-YEAR
BILLINGS CREEK		
Upstream of confluence with Shohola Creek	5.1	745
BLOOMING GROVE CREEK		
Downstream of State Route 402	14.1	2,000
Upstream of confluence with Gates Run	11.3	1,610
Upstream of confluence with Fairview Outlet	5.1	740
SHOHOLA CREEK		
Downstream of study limit	29.6	4,135
Upstream of confluence with McConnel Creek	25.4	3,560
Upstream of confluence with Billings Creek	19.9	2,800
Upstream of confluence with York Creek	15.0	2,125

3.2 Hydraulic Analyses

Analyses of the hydraulic characteristics of flooding from the sources studied were carried out to provide estimates of the elevations of floods of the selected recurrence intervals.

Cross sections for the backwater analysis for the streams studied by detailed methods were photogrammetrically surveyed or field surveyed (Reference 1). Cross sections were located at close intervals above and below bridges and culverts in order to compute the significant backwater effects of these structures. The ground control for the photogrammetry was acquired using inertial surveying techniques (Reference 2).

Locations of selected cross sections used in the hydraulic analyses are shown on the Flood Profiles (Exhibit 1) and the Flood Insurance Rate Map (Exhibit 2) where applicable.

Water-surface elevations of floods of the selected recurrence intervals were computed using the COE HEC-2 step-backwater computer program (Reference 3). Flood profiles were drawn showing computed water-surface elevations for floods of the selected recurrence intervals. Starting water-surface elevations for the streams studied by detailed methods were obtained from backwater computations of their respective main stems or from normal depth computations, as appropriate. The results of the water-surface elevations are tabulated for selected cross sections (Table 2).

Roughness factors (Manning's "n") used in the hydraulic computations were chosen on the basis of engineering judgment and field observations of the stream and floodplain areas (Reference 4). The channel "n" value for the streams studied by detailed methods was 0.045, and the overbank "n" value was 0.090.

The hydraulic analyses for this study were based on unobstructed flow. The flood elevations shown on the profiles are thus considered valid only if hydraulic structures remain unobstructed, operate properly, and do not fail.

All elevations are referenced to the National Geodetic Vertical Datum of 1929 (NGVD). Elevation reference marks used in this study are shown on the maps; the descriptions of the marks are presented in Elevation Reference Marks (Exhibit 3).

4.0 FLOODPLAIN MANAGEMENT APPLICATIONS

The NFIP encourages State and local governments to adopt sound floodplain management programs. Therefore, each Flood Insurance Study provides 100-year flood elevations and delineations of the 100-year floodplain boundaries to assist communities in developing floodplain management measures.

FLOODING SOURCE		STREAM CHANNEL			LEFT OVERBANK			RIGHT OVERBANK			100 YEAR FLOOD WATER SURFACE ELEVATION
CROSS SECTION	DISTANCE (FT.)	WIDTH (FT.)	DISCHARGE (CFS)	MEAN VELOCITY (FT./SEC.)	WIDTH (FT.)	DISCHARGE (CFS)	MEAN VELOCITY (FT./SEC.)	WIDTH (FT.)	DISCHARGE (CFS)	MEAN VELOCITY (FT./SEC.)	
A (2)	925	10	80	2.0	560	610	0.6	180	60	0.4	1288.0
B (2)	2200	10	160	3.1	560	480	0.7	120	110	0.8	1288.0
C	3675	40	120	0.7	295	330	0.3	465	290	0.3	1290.5
D	5375	5	110	5.5	120	500	2.1	185	140	1.2	1290.8

(2) Topwidth adjusted due to backwater from Shohola Creek.

TABLE 2

FEDERAL EMERGENCY MANAGEMENT AGENCY

Township of Blooming Grove
Pike County
Pennsylvania

REGULATORY DATA

Billings Creek

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FLOODING SOURCE		STREAM CHANNEL			LEFT OVERBANK			RIGHT OVERBANK			100 YEAR FLOOD WATER SURFACE ELEVATION
CROSS SECTION	DISTANCE (FT.)	WIDTH (FT.)	DISCHARGE (CFS)	MEAN VELOCITY (FT./SEC.)	WIDTH (FT.)	DISCHARGE (CFS)	MEAN VELOCITY (FT./SEC.)	WIDTH (FT.)	DISCHARGE (CFS)	MEAN VELOCITY (FT./SEC.)	
A	1100	30	1130	11.6	70	790	4.8	15	80	3.6	1396.4
B	2650	25	840	7.8	20	100	2.4	100	670	3.0	1406.4
C	5000	55	990	4.2	135	560	1.6	25	60	1.3	1414.4
D (1)	8600	35	1080	6.1	350	120	1.9	85	420	1.9	1430.2
E (1)	9450	35	1050	5.3	95	520	1.9	60	40	1.5	1433.0
F	10350	40	1340	7.3	15	80	2.2	35	180	2.3	1436.1
G	11225	20	800	11.4	15	110	3.5	90	700	3.8	1441.3
H	12625	55	640	3.0	115	220	1.1	250	740	1.2	1447.1
I	13825	30	390	4.8	290	220	1.1	75	140	1.5	1449.3
J	14900	20	180	2.6	540	430	0.8	60	130	1.0	1453.8
K	16950	80	190	1.4	445	200	0.5	440	350	0.6	1455.6

(1) Topwidth adjusted due to ineffective flow areas.

TABLE 2

FEDERAL EMERGENCY MANAGEMENT AGENCY

Township of Blooming Grove
Pike County
Pennsylvania

REGULATORY DATA

Blooming Grove Creek

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FLOODING SOURCE		STREAM CHANNEL			LEFT OVERBANK			RIGHT OVERBANK			100 YEAR FLOOD WATER SURFACE ELEVATION
CROSS SECTION	DISTANCE (FT.)	WIDTH (FT.)	DISCHARGE (CFS)	MEAN VELOCITY (FT./SEC.)	WIDTH (FT.)	DISCHARGE (CFS)	MEAN VELOCITY (FT./SEC.)	WIDTH (FT.)	DISCHARGE (CFS)	MEAN VELOCITY (FT./SEC.)	
A	875	25	530	4.4	380	2300	1.8	240	740	1.5	1260.5
B	2500	80	3140	7.5	20	110	2.3	50	310	2.4	1265.7
C	4200	35	3000	13.7	5	80	3.5	35	490	4.5	1279.4
D (1)	4800	35	1450	7.1	230	820	2.0	659	1280	2.0	1286.1
E	6500	40	950	3.5	445	1700	1.1	70	150	0.9	1289.3
F	8400	20	390	2.9	370	1180	0.9	355	560	0.7	1290.5
G	9725	45	310	2.6	5	3	0.7	480	1810	1.5	1292.9

(1) Topwidth adjusted due to ineffective flow areas.

TABLE 2

FEDERAL EMERGENCY MANAGEMENT AGENCY

Township of Blooming Grove
Pike County
Pennsylvania

REGULATORY DATA

Shohola Creek

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4.1 Floodplain Boundaries

To provide a national standard without regional discrimination, the 1 percent annual chance (100-year) flood has been adopted by FEMA as the base flood for floodplain management purposes. For the streams studied in detail, the 100-year floodplain boundaries have been delineated using the flood elevations determined at each cross section. Between cross sections, the boundaries were interpolated using topographic maps at a scale of 1:24,000 with a contour interval of 20 feet (Reference 5).

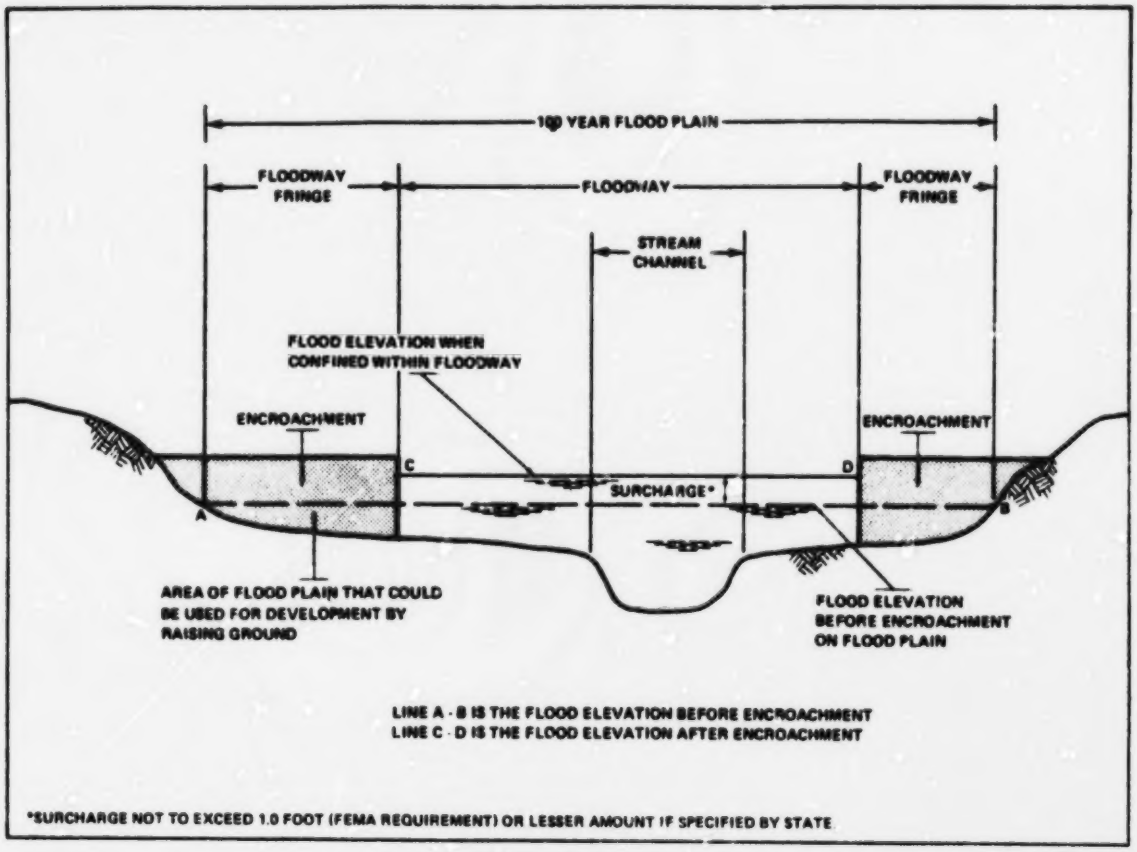
For the flooding sources studied by approximate methods, the floodplain boundaries were delineated using the Flood Hazard Boundary Map for the Township of Blooming Grove (Reference 6).

The 100-year floodplain boundaries are shown on the Flood Insurance Rate Map (Exhibit 2). On this map, the 100-year floodplain boundary corresponds to the boundary of the areas of special flood hazards (Zones A and AE). Small areas within the floodplain boundaries may lie above the flood elevations but cannot be shown due to limitations of the map scale and/or lack of detailed topographic data.

4.2 Floodways

Encroachment on floodplains, such as structures and fill, reduces flood-carrying capacity, increases flood heights and velocities, and increases flood hazards in areas beyond the encroachment itself. One aspect of floodplain management involves balancing the economic gain from floodplain development against the resulting increase in flood hazard. For purposes of the National Flood Insurance Program, a floodway is used as a tool to assist local communities in this aspect of floodplain management. Under this concept, the area of the 100-year floodplain is divided into a floodway and a floodway fringe. The floodway is the channel of a stream, plus any adjacent floodplain areas, that must be kept free of encroachment so that the 100-year flood can be carried without substantial increases in flood heights. Minimum federal standards limit such increases to 1.0 foot, provided that hazardous velocities are not produced.

The area between the floodway and 100-year floodplain boundaries is termed the floodway fringe. The floodway fringe encompasses the portion of the floodplain that could be completely obstructed without increasing the water-surface elevation of the 100-year flood by more than 1.0 foot at any point. Typical relationships between the floodway and the floodway fringe and their significance to floodplain development are shown in Figure 2.


100 YEAR FLOOD PLAIN
FLOODWAY FRINGE
FLOODWAY
FLOODWAY FRINGE
STREAM CHANNEL
FLOOD ELEVATION WHEN CONFINED WITHIN FLOODWAY
ENCROACHMENT
ENCROACHMENT
C
D
SURCHARGE*
A
B
AREA OF FLOOD PLAIN THAT COULD BE USED FOR DEVELOPMENT BY RAISING GROUND
FLOOD ELEVATION BEFORE ENCROACHMENT ON FLOOD PLAIN
LINE A - B IS THE FLOOD ELEVATION BEFORE ENCROACHMENT
LINE C - D IS THE FLOOD ELEVATION AFTER ENCROACHMENT
*SURCHARGE NOT TO EXCEED 1.0 FOOT (FEMA REQUIREMENT) OR LESSER AMOUNT IF SPECIFIED BY STATE

FLOODWAY SCHEMATIC Figure 2

No floodways were calculated as part of this study.

5.0 INSURANCE APPLICATION

For flood insurance rating purposes, flood insurance zone designations are assigned to a community based on the results of the engineering analyses. These zones are as follows:

Zone A

Zone A is the flood insurance rate zone that corresponds to the 100-year floodplains that are determined in the Flood Insurance Study by approximate methods. Because detailed hydraulic analyses are not performed for such areas, no base flood elevations or depths are shown within this zone.

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Zone AE

Zone AE is the flood insurance rate zone that corresponds to the 100-year floodplains that are determined in the Flood Insurance Study by detailed methods. In most instances, whole-foot base flood elevations derived from the detailed hydraulic analyses are shown at selected intervals within this zone.

Zone AH

Zone AH is the flood insurance rate zone that corresponds to the areas of 100-year shallow flooding (usually areas of ponding) where average depths are between 1 and 3 feet. Whole-foot base flood elevations derived from the detailed hydraulic analyses are shown at selected intervals within this zone.

Zone AO

Zone AO is the flood insurance rate zone that corresponds to the areas of 100-year shallow flooding (usually sheet flow on sloping terrain) where average depths are between 1 and 3 feet. Average whole-foot depths derived from the detailed hydraulic analyses are shown within this zone.

Zone A99

Zone A99 is the flood insurance rate zone that corresponds to areas of the 100-year floodplain that will be protected by a Federal flood protection system where construction has reached specified statutory milestones. No base flood elevations or depths are shown within this zone.

Zone V

Zone V is the flood insurance rate zone that corresponds to the 100-year coastal floodplains that have additional hazards associated with storm waves. Because approximate hydraulic analyses are performed for such areas, no base flood elevations are shown within this zone.

Zone VE

Zone VE is the flood insurance rate zone that corresponds to the 100-year coastal floodplains that have additional hazards associated with storm waves. Whole-foot base flood elevations derived from the detailed hydraulic analyses are shown at selected intervals within this zone.

Zone X

Zone X is the flood insurance rate zone that corresponds to areas outside the 500-year floodplain, areas within the 500-year floodplain, and to areas of 100-year flooding where average depths are less than 1 foot, areas of 100-year flooding where the contributing drainage area is less than 1 square mile, and areas protected from the 100-year flood by levees. No base flood elevations or depths are shown within this zone.

Zone D

Zone D is the flood insurance rate zone that corresponds to unstudied areas where flood hazards are undetermined, but possible.

6.0 FLOOD INSURANCE RATE MAP

The Flood Insurance Rate Map is designed for flood insurance and floodplain management applications.

For flood insurance applications, the map designates flood insurance rate zones as described in Section 5.0 and, in the 100-year floodplains that were studied by detailed methods, shows selected whole-foot base flood elevations or average depths. Insurance agents use the zones and base flood elevations in conjunction with information on structures and their contents to assign premium rates for flood insurance policies.

For floodplain management applications, the map shows by tints, screens, and symbols, the 100-year floodplain. The locations of selected cross sections used in the hydraulic analyses are shown where applicable.

7.0 OTHER STUDIES

Due to its more detailed nature, this study supersedes the Flood Hazard Boundary Map for the Township of Blooming Grove (Reference 6).

8.0 LOCATION OF DATA

Information concerning the pertinent data used in preparation of this study can be obtained by contacting FEMA, the Natural and Technological Hazards Division, Liberty Square Building (Second Floor), 105 South Seventh Street, Philadelphia, Pennsylvania 19106.

9.0 BIBLIOGRAPHY AND REFERENCES

1. Aerial Data Reduction Associates, Inc., of Pennsauken, New Jersey, Aerial Photogrammetric and Field Surveys of Monroe, Wayne and Pike Counties, Pennsylvania, September 1985 to January 1986.

2. Nortech (U. S. A.) Inc., Report on the Federal Emergency Management Agency Project, Inertial Elevation Survey for United States Army Corps of Engineers for Aerial Data Reduction Associates Inc., October/November 1985.

3. U. S. Army Corps of Engineers, Hydrologic Engineering Center, HEC-2 Water Surface Profiles, Generalized Computer Program, Users Manual, Davis, California, 1982.

4. Ven Te Chow, Open-Channel Hydraulics, New York, McGraw-Hill, 1959.

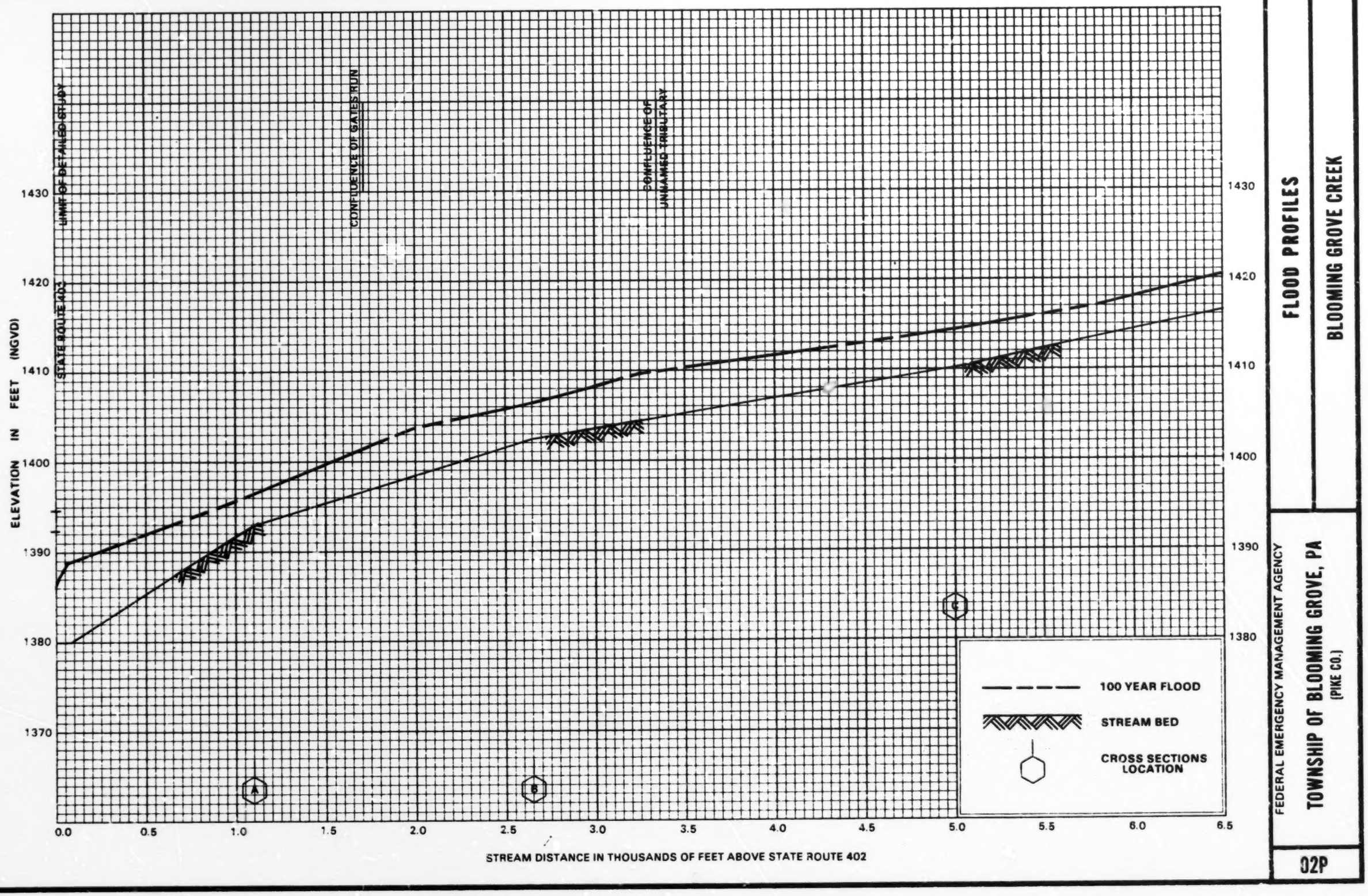
5. U. S. Department of the Interior, Geological Survey, 7.5-Minute Series Topographic Maps, Scale 1:24,000, Contour Interval 20 Feet: Hawley, Pennsylvania, 1966, Photorevised 1983; Promised Land, Pennsylvania, 1966, Photorevised 1973; Pecks Pond, Pennsylvania, 1966, Photorevised 1983.

6. U. S. Department of Housing and Urban Development, Federal Insurance Administration, Flood Hazard Boundary Map, Township of Blooming Grove, Pike County, Pennsylvania, November 16, 1979.

Community Map, General Highway Map, Pike County, Pennsylvania, 1981.

EXHIBIT 3 - ELEVATION REFERENCE MARKS

Reference Mark	FIRM Panel	Elevation (Feet NGVD)	Description of Location
RM 1	15	1,454.56	Access road bridge over Blooming Grove Creek. P.K. nail in top of downstream timber curbing at northeast abutment.
RM 2	15	1,444.20	Legislative Route 51019 bridge over Blooming Grove Creek. Square cut in top of north downstream corner of steel curbing.
RM 3	15	1,438.90	Access road (P.P. & L.) bridge over Blooming Grove Creek. Square cut in top of northeast corner of downstream bridge wall.
RM 4	15	1,397.46	State Route 402 bridge over Blooming Grove Creek. Square cut in top of downstream bridge wall at north abutment.
RM 5	10	1,301.14	Spring Road bridge over Shohola Creek. Cross cut in top of I-beam flange of downstream guide rail at northeast abutment.
RM 6	10	1,287.76	Legislative Route 51019 bridge over Billings Creek. Painted square on top of downstream end of 5.0-foot diameter CMP.
RM 7	10	1,281.55	State Route 739 bridge over Shohola Creek. Square cut in top of downstream corner of steel curbing at northeast abutment.



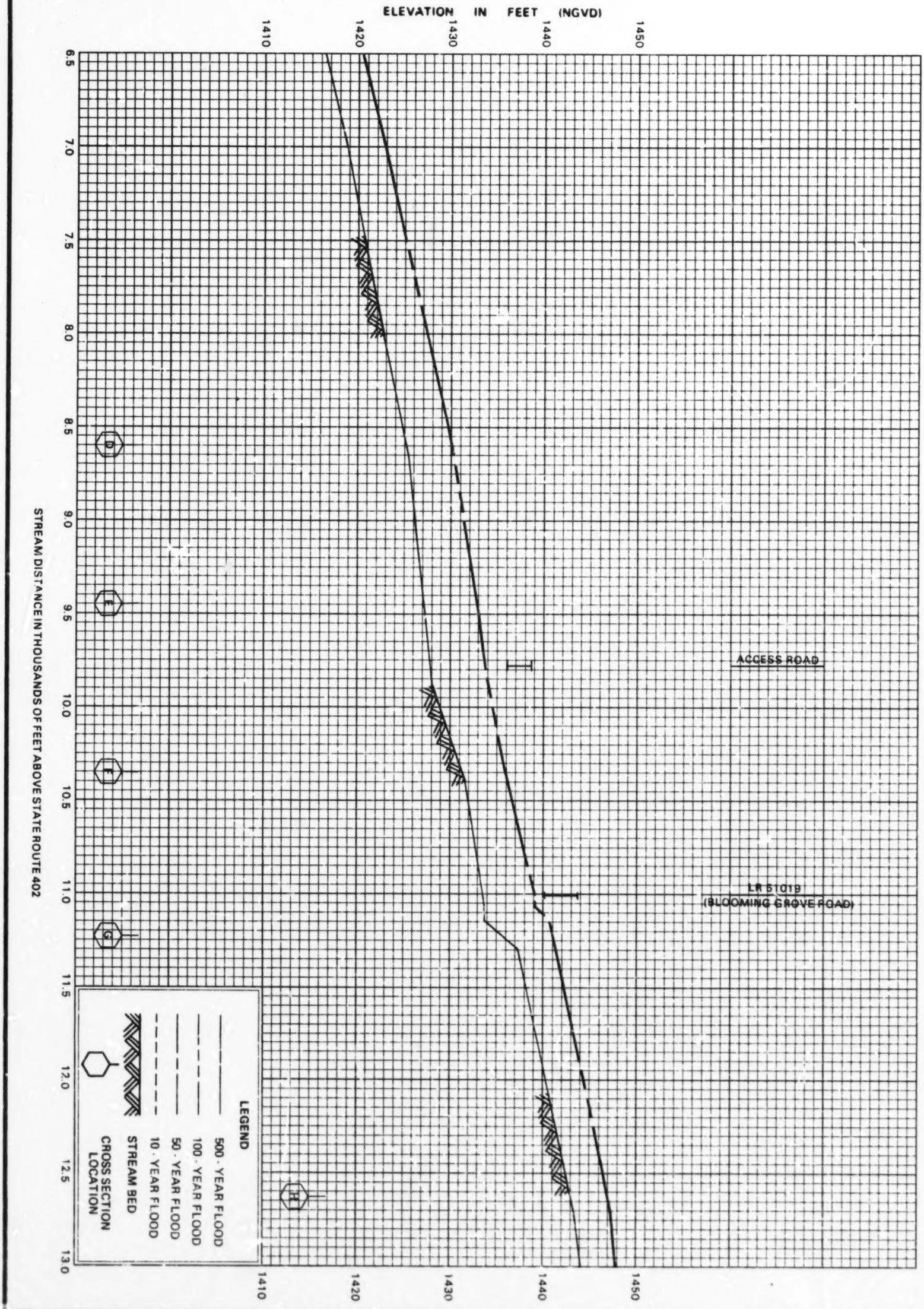
FLOOD PROFILES

BLOOMING GROVE CREEK

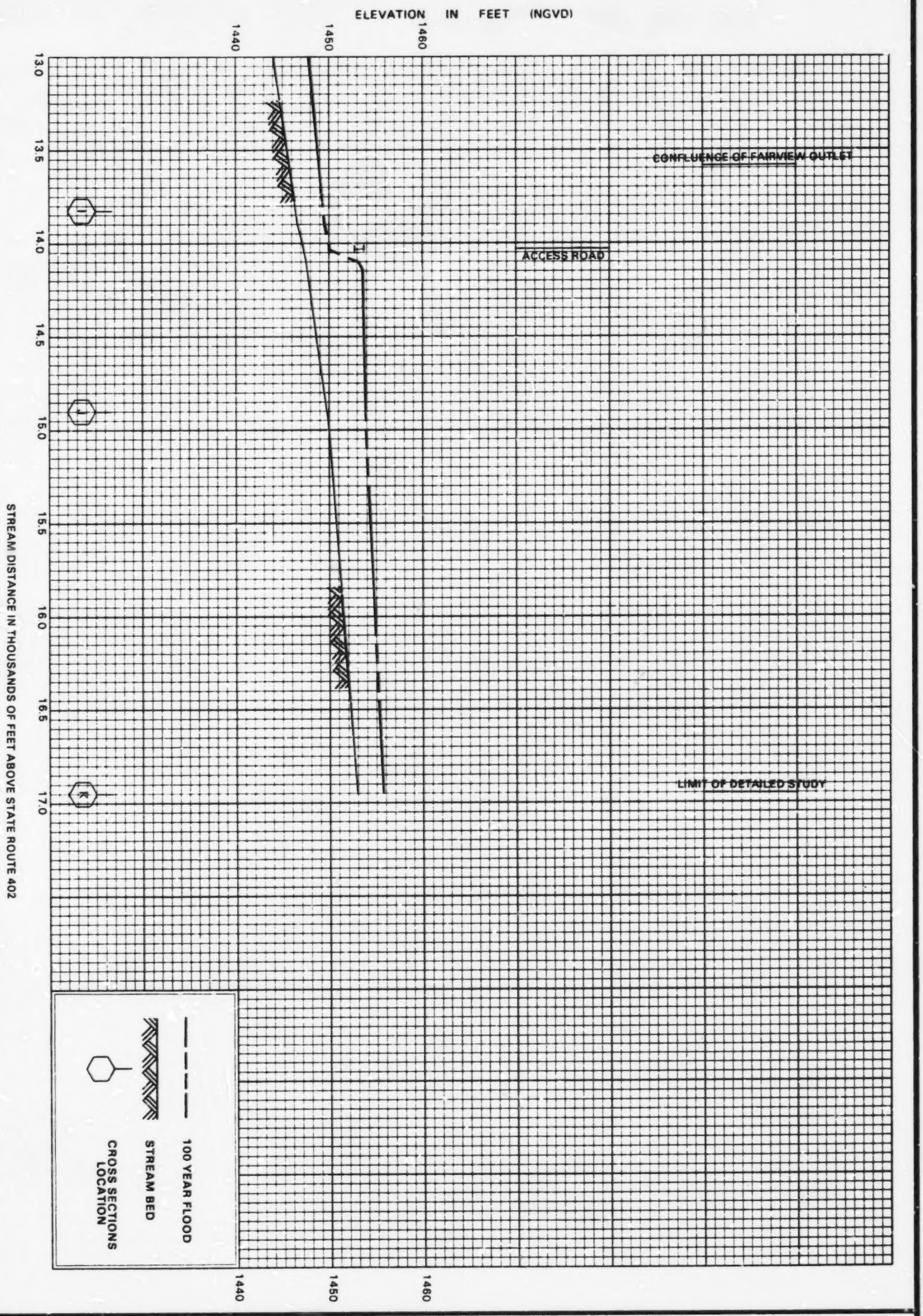
FEDERAL EMERGENCY MANAGEMENT AGENCY

TOWNSHIP OF BLOOMING GROVE, PA
(PIKE CO.)

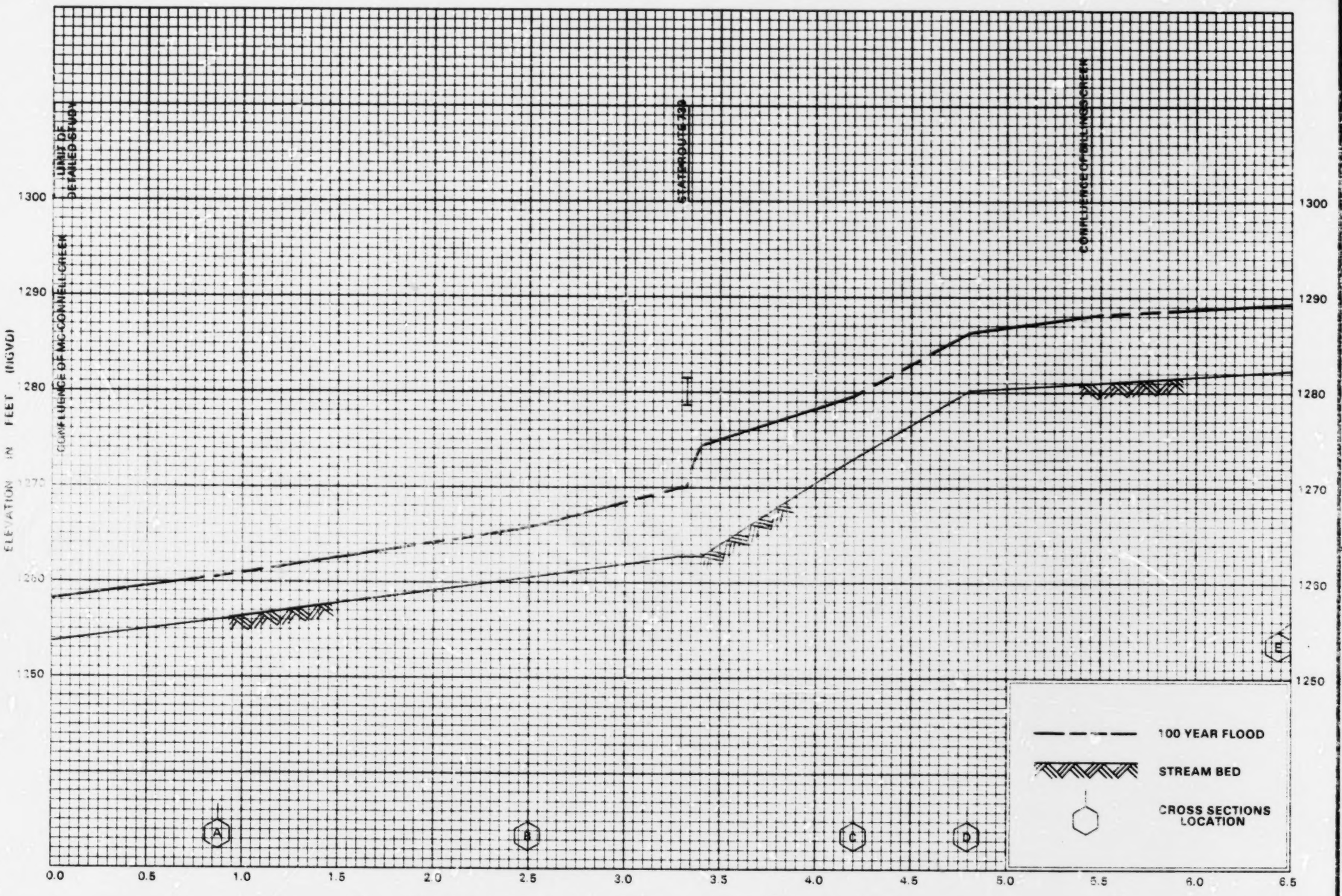
02P



03P	FEDERAL EMERGENCY MANAGEMENT AGENCY **TOWNSHIP OF BLOOMING GROVE, PA** (PIKE CO.)	**FLOOD PROFILES** **BLOOMING GROVE CREEK**



04P	FEDERAL EMERGENCY MANAGEMENT AGENCY **TOWNSHIP OF BLOOMING GROVE, PA** (PIKE CO.)	**FLOOD PROFILES** **BLOOMING GROVE CREEK**



FLOOD PROFILES

SHOHOLA CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

TOWNSHIP OF BLOOMING GROVE, PA
(PIKE CO.)

05P

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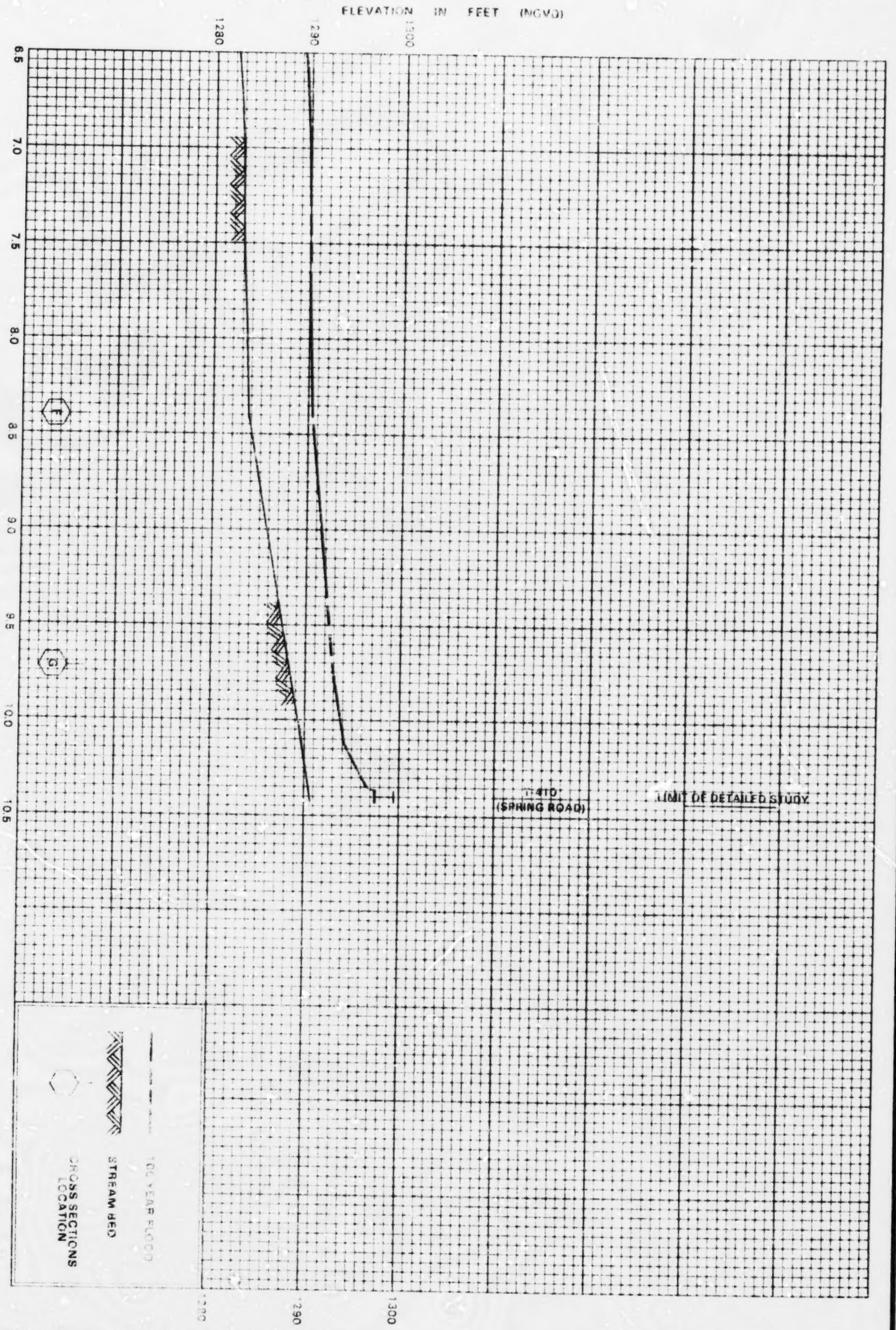

FEDERAL EMERGENCY MANAGEMENT AGENCY

TOWNSHIP OF BLOOMING GROVE, PA
(PIKE CO.)

06P

FLOOD PROFILES

SHOHOLA CREEK

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